Suitability of Sandy Beach Foreshores As Habitat: Examples From Two Estuaries

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Understanding beach morphodynamics is important to identifying potential relationships between biological productivity and beach change in estuaries and predicting the effects of shore management strategies on habitat suitability. The results of two field investigations will be presented. The first investigation examines the effect of bulkheads on sandy beaches and abundance of meiofauna at a site in Raritan Bay. The second investigation examines the use of sandy foreshores by horseshoe crabs, the contribution of wave activation and bioturbation on bed elevation and sediment disturbance at a site in Delaware Bay, Delaware.

Many sandy beaches in Raritan Bay have been altered by shore stabilization to minimize risk to human settlements from erosion and flooding. A field investigation was conducted on an estuarine sand beach foreshore in Raritan Bay to document meiofaunal abundance at 2 sites fronting bulkheads and at an adjacent site where no bulkhead is present. Data on waves, water temperature and salinity were gathered over a spring tidal cycle. Data on meiofauna and sediment characteristics were gathered at low water across the foreshore where a bulkhead intersects low on the profile; where a bulkhead intersects high on the profile; and where there is no bulkhead present. Mean grain size of sediments is in the range of medium to coarse sand; mean grain size is slightly finer at locations fronting the bulkheads than at a similar profile elevation on the site where no bulkhead is present. Significant wave heights, measured on the low tide terrace, ranged from 0.08 m at high water to 0.27 m during rising tide. Peak wave periods ranged from 2.0 to 2.7 s. Greatest net change in sand surface elevation (0.07 m of erosion) and depth of sediment activation (0.23 m) over the tidal cycle occurred at the base of the bulkhead that was low on the profile. Data from the top core segments at that location reveal lower meiofaunal density at the base of the bulkhead compared to the sampling station lower on the profile and to sampling stations at a similar profile elevation on both other sites. Increased energy at the base of the bulkhead low on the profile resulted in the transport of meiofauna with eroded sediments. Bulkheads constructed low on the profile can have the greatest negative impact on individuals near the base of the structure. Construction of bulkheads higher on the intertidal profile does not appear to alter the suitability of the beach matrix as habitat.

The beaches in Delaware Bay serve as a spawning ground for horseshoe crabs as well as a stopover site for migratory shorebirds who feed on exhumed crab eggs. A three-day investigation was conducted on an estuarine sand beach foreshore in Delaware Bay to assess the role of wave activation and bioturbation on foreshore sediment disturbance. An exclosure, extending 25 m alongshore and 8 m across the shore from the upper limit of swash to the break in slope between the foreshore and low tide terrace, was constructed to

minimize the effects of sediment disturbance by horseshoe crab spawning. Net change of the sand surface elevation and depth of sediment activation across the foreshore were determined using rods driven into the sand at 1 m intervals along two shore-perpendicular transects. One transect was located inside the exclosure and one transect was located outside the exclosure. Surface sediment samples and sediment cores were gathered along each transect at times of low water. Egg densities across the foreshore were determined from 5 cm diameter sediment cores taken to a depth of 20 cm. Data on wind, wave and currents were gathered at high tide. Significant wave heights, measured on the lower foreshore, ranged from 0.06 m to 0.15 m at high tide. Greatest net change in sand surface elevation (0.08 m of erosion) and maximum depth of sediment activation (0.11 m) occurred on the upper foreshore outside the exclosure. Within the exclosure, net change in sand surface elevation (0.04 m erosion) and sediment activation (0.07 m) occurred on the lower foreshore near the location of wave breaking during this time. Spawning activity resulted in erosion on the upper foreshore and deposition on the lower foreshore outside the exclosure. Surface sediments outside the exclosure had a far greater percentage of gravel than the surface sediments within the exclosure.